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PCT

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

not yet known

09/700577

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/EP99/02942

April 30, 1999

May 11, 1998

TITLE OF INVENTION

METHOD AND APPARATUS FOR THE THERMAL TREATMENT OF SUBSTRATES

APPLICANT(S) FOR DO/EO/US

Helmut Aschauer, Patrick Schmid, Dieter Reinicke

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

1. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
2. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
3. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
4. ☐ A substitute specification.
5. ☐ A change of power of attorney and/or address letter.
6. ☒ Other items or information:
Substitute drawings for Figures 1, 2 and 4

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Date of Deposit November 13, 2000 (Monday)

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of patents and trade marks, Washington, D.C. 20231.

Mary Ann Copas Secretary

U.S. APPLICATION NO. (If known, 37 CFR 1.53) no 09/700577				INTERNATIONAL APPLICATION NO. PCT/EP99/02942		ATTORNEY'S DOCKET NUMBER Az.2511	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1070.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$930.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$790.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$720.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$98.00 ENTER APPROPRIATE BASIC FEE AMOUNT =						CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).						\$ 860.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE				
Total claims	13 - 20 =	0	x \$22.00				
Independent claims	2 - 3 =	0	x \$82.00				
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ \$270.00			
TOTAL OF ABOVE CALCULATIONS =						\$ 860.00	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				+			
SUBTOTAL =						\$ 860.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).							
TOTAL NATIONAL FEE =						\$ 860.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +						\$ 40.00	
TOTAL FEES ENCLOSED =						\$ 900.00	
						Amount to be refunded:	\$
						charged:	\$

- a. ☒ A check in the amount of \$ 900.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 02-1653 A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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NAME
26,255
REGISTRATION NUMBER

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Date of Deposit November 13, 2000 (Monday)

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.


Mary Ann Copas, Secretary

In the Application of Helmut Aschner, et al.

Ser.No.: Not Yet Known (based on DE 198 21 007.8 filed 11 May 1998 and PCT/EP99/02942 filed 30 April 1999)

For: METHOD AND APPARATUS FOR THE THERMAL TREATMENT OF SUBSTRATES

Date Filed: November 13, 2000 (Monday)

Box PCT
Assistant Commissioner for Patents
Washington, DC 20231

**PRELIMINARY AMENDMENT ACCOMPANYING ENTRY INTO
NATIONAL STAGE APPLICATION**

Sir:

Prior to examination, please amend the above-identified application as follows.

IN THE SPECIFICATION:

On page 1, immediately after the title, please insert the following heading:

--Background of the Invention--.

On page 3, at between lines 2 and 3, please insert the following heading:

--Summary of the Invention--.

On page 5, line 20, please insert the following heading:

--Brief Description of the Drawing--;

On page 6, line 21, please insert the following heading:

--Description of Preferred Embodiments--.

On page 10, at line 13, please insert the following paragraph:

--The specification incorporates by reference the disclosure of German priority

document 198 21 007.8 of 11 May 1998 and International priority document PCT/DE99/02942 of 30 April 1999.

The present invention is, of course, in no way restricted to the specific disclosure of the specification and drawings, but also encompasses any modifications within the scope of the appended claims.--

IN THE CLAIMS:

Please cancel claims 1 - 13, and replace them with the attached claims 14 - 26.

IN THE DRAWINGS:

Enclosed are the following drawings for substitution of those filed with the PCT:

- Fig. 1 Modified to include reference numeral 5 for the reaction chamber.
Fig. 2 Modified to include reference numeral 5 for the reaction chamber.
Fig. 4 Modified to correct reverse labeling of reference numerals 30 and 31.


REMARKS

Claims 14 - 26 are pending in the application.

Appropriate headings have been added to the specification and the claims from the literal translation have been replaced by claims drafted in conformity with U.S. Patent practice.

The application in its amended state is believed to be in condition for allowance. However, should the Examiner have any comments or suggestions, or wish to discuss the merits of the application, the undersigned would very much welcome a telephone call in order to be able to expedite placement of the application into condition for allowance.

Respectfully submitted,


Robert W. Becker Reg. No. 26,255
for Applicant(s)

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WHAT WE CLAIM IS:

14. An apparatus for the thermal treatment of substrates, comprising:

a housing having a reaction chamber; and

5 a temperature-compensating element disposed in said reaction chamber for surrounding an outer periphery of a substrate, wherein said compensating element is spaced from said substrate and is essentially disposed in the plane of said substrate, wherein said compensating element is at least partially pivotable in said reaction chamber relative to said plane of said substrate.

10 15. An apparatus according to claim 14, wherein a pivot device is disposed in said reaction chamber.

16. An apparatus according to claim 15, wherein said pivot device is essentially spaced from said compensating element, and wherein at least one connection element is provided for interconnecting said pivot device and said compensating element.

17. An apparatus according claim 15, wherein said pivot device is provided with a semi-circular member that has an inner radius that is greater than an outer radius of said substrate.

20 18. An apparatus according to claim 17, wherein said semi-circular member has free ends that are pivotably mounted in said reaction chamber.

19. An apparatus according claim 16, wherein said compensating element is pivotably mounted in said reaction chamber.

20. An apparatus according to claim 16, wherein said reaction chamber has a door, and wherein said pivot device is actuateable by movement of said chamber door.

21. An apparatus according to claim 20, wherein said pivot device is automatically pivotable by opening or closing of said chamber door.

22. An apparatus according to claim 16, wherein said compensating element is an annular element.

23. An apparatus according to claim 16, wherein said compensating element comprises a plurality of segments.

24. An apparatus according to claim 23, wherein said segments each have an annular segment of 60° .

25. A method for the thermal treatment of substrates in a reaction chamber having a compensation element that surrounds an outer periphery of a substrate and is spaced therefrom, wherein said compensation element is essentially disposed in the plane of said substrate, said method including the step of:

at least partially pivoting said compensation element in said reaction chamber relative to said plane of said substrate for providing a lateral access to said substrate for introducing or withdrawing said substrate.

26. A method according to claim 25, which includes the step of automatically pivoting said compensation element by opening or closing a door of said reaction chamber.

WHAT WE CLAIM IS:

14. An apparatus for the thermal treatment of substrates,
comprising:

a housing having a reaction chamber; and

a temperature-compensating element disposed in said
reaction chamber for surrounding an outer periphery of a substrate,
wherein said compensating element is spaced from said substrate and
is essentially disposed in the plane of said substrate, wherein said
compensating element is at least partially pivotable in said reaction
chamber relative to said plane of said substrate.

15. An apparatus according to claim 14, wherein a pivot device
is disposed in said reaction chamber.

16. An apparatus according to claim 15, wherein said pivot
device is essentially spaced from said compensating element, and
wherein at least one connection element is provided for interconnecting
said pivot device and said compensating element.

17. An apparatus according claim 15, wherein said pivot device
is provided with a semi-circular member that has an inner radius that is
greater than an outer radius of said substrate.

18. An apparatus according to claim 17, wherein said semi-
circular member has free ends that are pivotably mounted in said reaction
chamber.

19. An apparatus according claim 16, wherein said
compensating element is pivotably mounted in said reaction chamber.

for the Examiner's
Reference

20. An apparatus according to claim 16, wherein said reaction chamber ⁵ has a door, and wherein said pivot device ^{22,27} is actuateable by movement of said chamber door.

21. An apparatus according to claim 20, wherein said pivot device ^{22,27} is automatically pivotable by opening or closing of said chamber door.

22. An apparatus according to claim 16, wherein said compensating element ¹⁵ is an annular element.

23. An apparatus according to claim 16, wherein said compensating element ¹⁵ comprises a plurality of segments ^{16,17,18,19}.

24. An apparatus according to claim 23, wherein said segments each have an annular segment of 60°.

25. A method for the thermal treatment of substrates ² in a reaction chamber ⁵ having a compensation element ¹⁵ that surrounds an outer periphery of a substrate ² and is spaced therefrom, wherein said compensation element is essentially disposed in the plane of said substrate, said method including the step of:

at least partially pivoting said compensation element ¹⁵ in said reaction chamber ⁵ relative to said plane of said substrate ² for providing a lateral access to said substrate for introducing or withdrawing said substrate.

26. A method according to claim 25, which includes the step of automatically pivoting said compensation element ¹⁵ by opening or closing a door ⁵ of said reaction chamber.

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Method and Apparatus for the Thermal Treatment of Substrates

5 The present invention relates to an apparatus for the thermal treatment
of substrates, especially semi-conductor wafers, and includes a reaction
chamber and a compensation element that surrounds the outer periphery
of the substrate and is spaced therefrom. The present invention also
relates to a method for the thermal treatment of substrates, especially
semi-conductor wafers, in a reaction chamber having a compensation
element that surrounds the outer periphery of the substrate and is spaced
10 therefrom.

A method and an apparatus of this type are described in DE 36 27 598
C. A compensation ring is provided about a wafer in a reaction chamber
of the apparatus. During the thermal treatment of the wafer, the
15 compensation ring prevents edge effects. With this ring, for example a
more rapid heating up at the rim than at the inner region of the wafer
during a heating-up phase, and a more rapid cooling off during a cooling-
off phase, are avoided. Due to the compensation ring, temperature
inhomogeneities within the wafer are thus eliminated or at least reduced.
20 For a particularly good operation, the compensation ring is disposed
essentially on the same plane as the wafer that is to be treated.

In the past, during the loading and unloading of the substrate that is to be handled, the compensation ring was grasped together with the substrate and introduced or withdrawn, since a handling device could freely grasp the wafer.

5

This common handling of wafer and compensation ring requires a complicated handling apparatus that in addition to a wafer-grasping apparatus must also have a compensation ring-grasping apparatus. Furthermore, due to the common handling there is an increased danger of damage to the compensation ring and/or to the wafer.

10

US 5,683,518, as well as JP 10-098 048, each disclose apparatus for the thermal treatment of substrates and have a reaction chamber and a compensation element, according to which during the thermal treatment the substrate rests upon the compensation element and is raised together with it in the reaction chamber. For loading and unloading, the substrates are placed upon posts that extend through the compensation element, with the respective compensation elements being completely lowered.

15

It is therefore an object of the present invention to provide a method and an apparatus for the thermal treatment of substrates that facilitate an introduction and withdrawal of the wafer into or out of the reaction

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chamber.

Proceeding from the initially mentioned apparatus, the stated objective is realized in that the compensation element is at least partially pivotable in the reaction chamber. By at least partially pivoting the compensation element in the reaction chamber, a direct access of a handling device to the wafer is possible, since the compensation element can be pivoted out of the access region of the handling device. In this connection, it is not absolutely necessary that the entire compensation element be pivoted; rather, it is sufficient to partially pivot the compensation element in order to enable free access to the wafer.

A pivot device is advantageously provided in the reaction chamber for the compensation ring or parts thereof, so that no such device has to be introduced from the outside.

Pursuant to one preferred specific embodiment of the invention, the pivot device is essentially spaced from the compensation element and is connected therewith by at least one connecting element. Spacing the pivot device from the compensation element ensures that the pivot device will exert no or only a slight thermal effect upon the compensation element.

The pivot device advantageously has a semi-circular member having an inner radius that is greater than the outer radius of the compensation element in order to influence the thermal treatment of the substrate as little as possible. For a simple construction of the pivot device, the free ends of the semi-circular member are mounted in the reaction chamber.

Pursuant to a further specific embodiment of the invention, the compensation element itself is pivotably mounted, resulting in a particularly straightforward pivotability.

Due to the typical shape of the substrates that are to be handled, the compensation element is preferably an annular or ring element. Pursuant to one specific embodiment, the compensation element comprises a plurality of segments in order to facilitate manufacture of the compensation element. This applies in particular for large substrates since the compensation element is typically made of the same material as the substrate and it is therefore difficult to manufacture the compensation element in the required size as one piece. The segments advantageously have angular segments of 60° each. For smaller substrates, as well as for compensation elements that are not made of the same material as are the substrates that are to be handled, the compensation element is preferably a single piece.

Pursuant to one particularly preferred specific embodiment of the present invention, the pivot device can be controlled by movement of a door of the reaction chamber, and especially automatically by the opening or closing of the chamber door. By automatic pivoting together with the movement of the chamber door, there results a particularly straightforward actuation mechanism. The automatic pivoting furthermore ensures that when the chamber door is opened, access to the wafer is provided.

Proceeding from the initially described method, the stated objective is also inventively realized in that the compensation element is pivoted at least partially in the reaction chamber in order to facilitate the insertion and/or removal of the substrate. This again results in the advantage that the access to the substrate is provided and it can therefore be introduced and removed without obstruction.

The compensation element is advantageously automatically pivoted by opening or closing the door of the reaction chamber. This automatically ensures that access is provided to the substrate when the chamber door is opened.

The present invention will be subsequently explained with the aid of one preferred specific embodiment accompanied by reference to the drawing,

in which:

Figure 1 is a partial cross-sectional perspective view of one apparatus for the thermal treatment of substrates, whereby for simplification of the drawing parts have been omitted;

Figure 2 is a view similar to that of Figure 1, whereby an annular compensation element is illustrated in a lowered position;

Figure 3 is a partial cross-sectional view through an apparatus according to Fig. 1 having a raised annular compensation position;

Figure 4 is an enlarged detailed sectional view that shows the annular compensation segment in a raised segment;

Figure 5 is a cross-sectional view similar to that of Fig. 3, whereby the annular compensation segment is shown in a lowered position;

Figure 6 is an enlarged detailed sectional view showing the annular compensation segment in a lowered position.

Figures 1 and 2 show an apparatus 1 for the rapid thermal treatment of

semiconductor wafers 2. The apparatus 1 is provided with a reaction chamber 5 that is formed by upper and lower quartz plates 7, 8 as well as lateral liner elements 9, which are all accommodated in a housing 10. Non-illustrated radiation sources are provided for heating the wafer 2.

5

Provided within the reaction chamber are a plurality of support elements 12 upon which the wafer 2 is placed. These support elements are disposed on a rotary plate 14 that is driven by a non-illustrated device for rotating the wafer.

10

Disposed about the outer periphery of the wafer 2 is an annular compensation element 15 that is divided into a plurality of segments 16, 17, 18, 19. In the illustrated embodiment, the annular segments 16, 17, 18, 19 are annular segments of 60° each, whereby the annular segments could also describe a greater or lesser angle. Although the compensation ring is illustrated as being segmented, it is also possible for the compensation ring to be one piece.

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By means of a rib or leg 20, the annular segment 16 is connected to an essentially semi-circular, pivotable raising and lowering element 22, the free end of which, as indicated at 25, is pivotably mounted in the reaction chamber. A control lever 27 extends from the pivotable raising and

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already indicated, it is also not necessary for the compensation ring 15 to be segmented. It is also possible to pivotably mount the compensation ring 15 or its segments in the reaction chamber without the use of a pivotable raising and lowering element, as a result of which a separate raising and lowering element can be eliminated and only a single control element for a pivoting of the compensation element 15 itself would be required.

Patent Claims:

1. Apparatus (1) for the thermal treatment of substrates (2), especially semi-conductor wafers, having a reaction chamber (5) and a compensation element (15) that surrounds the outer periphery of the substrate and is spaced therefrom, characterized in that the compensation element (15) is at least partially pivotable in the reaction chamber (5).
2. Apparatus according to claim 1, characterized by a pivot device (22, 27) in the reaction chamber.
3. Apparatus according to claim 2, characterized in that the pivot device (22, 27) is essentially spaced from the compensation element (15) and is connected therewith by at least one connecting element (20).
4. Apparatus according to one of the claims 2 or 3, characterized in that the pivot device is provided with a semi-circular member (22) having an inner radius that is greater than the outer radius of the substrate (2).
5. Apparatus according to claim 4, characterized in that the free end (23) of the semi-circular member (22) is pivotably mounted in the reaction chamber (5).
6. Apparatus according to one of the preceding claims, characterized in that the compensation element (15) is pivotably mounted in the

reaction chamber (5).

7. Apparatus according to one of the claims 2 to 6, characterized in that the pivot device (22, 27) is actuatable by movement of a door of the reaction chamber (5).

5 8. Apparatus according to claim 7, characterized in that the pivot device (22, 27) is automatically pivotable by opening or closing of the chamber door.

9. Apparatus according to one of the preceding claims, characterized in that the compensation element (15) is an annular element.

10 10. Apparatus according to one of the preceding claims, characterized in that the compensation element (15) comprises a plurality of segments (16, 17, 18, 19).

11. Apparatus according to claim 10, characterized in that the segments each have an annular segment of 60° .

15 12. Method for the thermal treatment of substrates (2), especially semi-conductor wafers, in a reaction chamber (5) having a compensation element (15) that surrounds the outer periphery of the substrate and is spaced therefrom, characterized in that the compensation element (15), for the introduction and/or withdrawal
20 of the substrate (2), is at least partially pivoted in the reaction chamber (15).

13. Method according to claim 12, characterized in that the

compensation element (15) is automatically pivoted by opening or closing a door of the reaction chamber (5).



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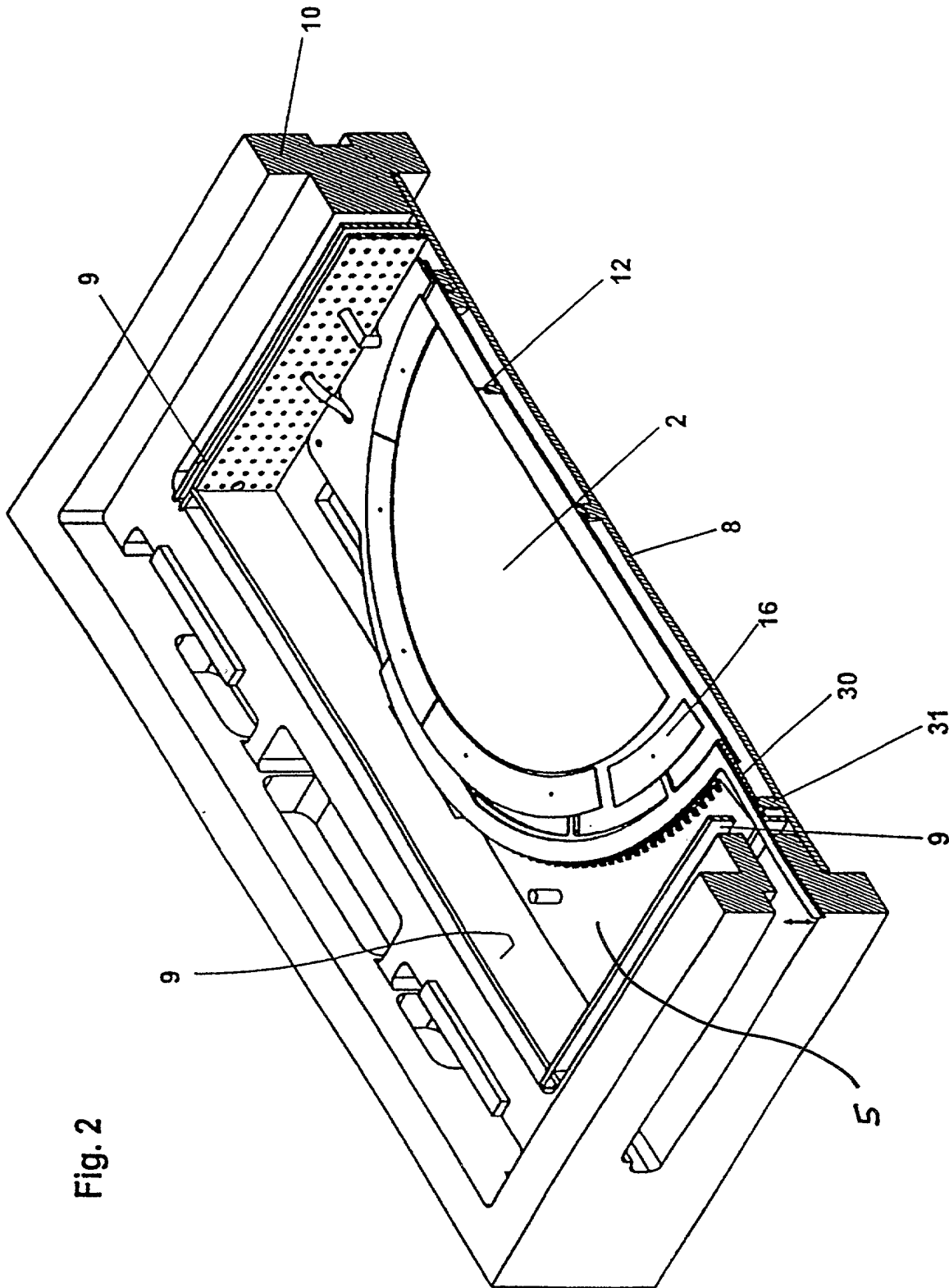
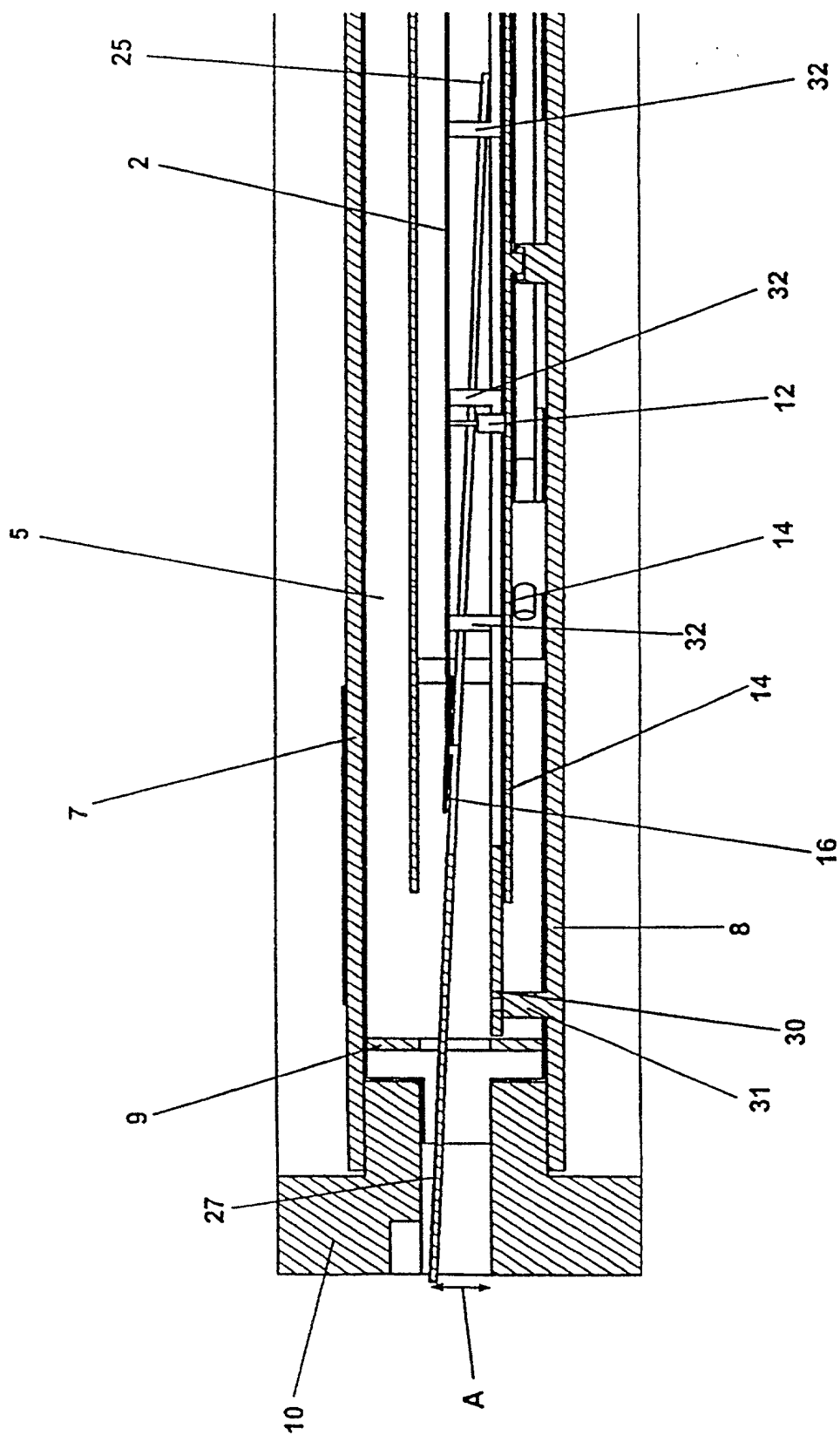


Fig. 2

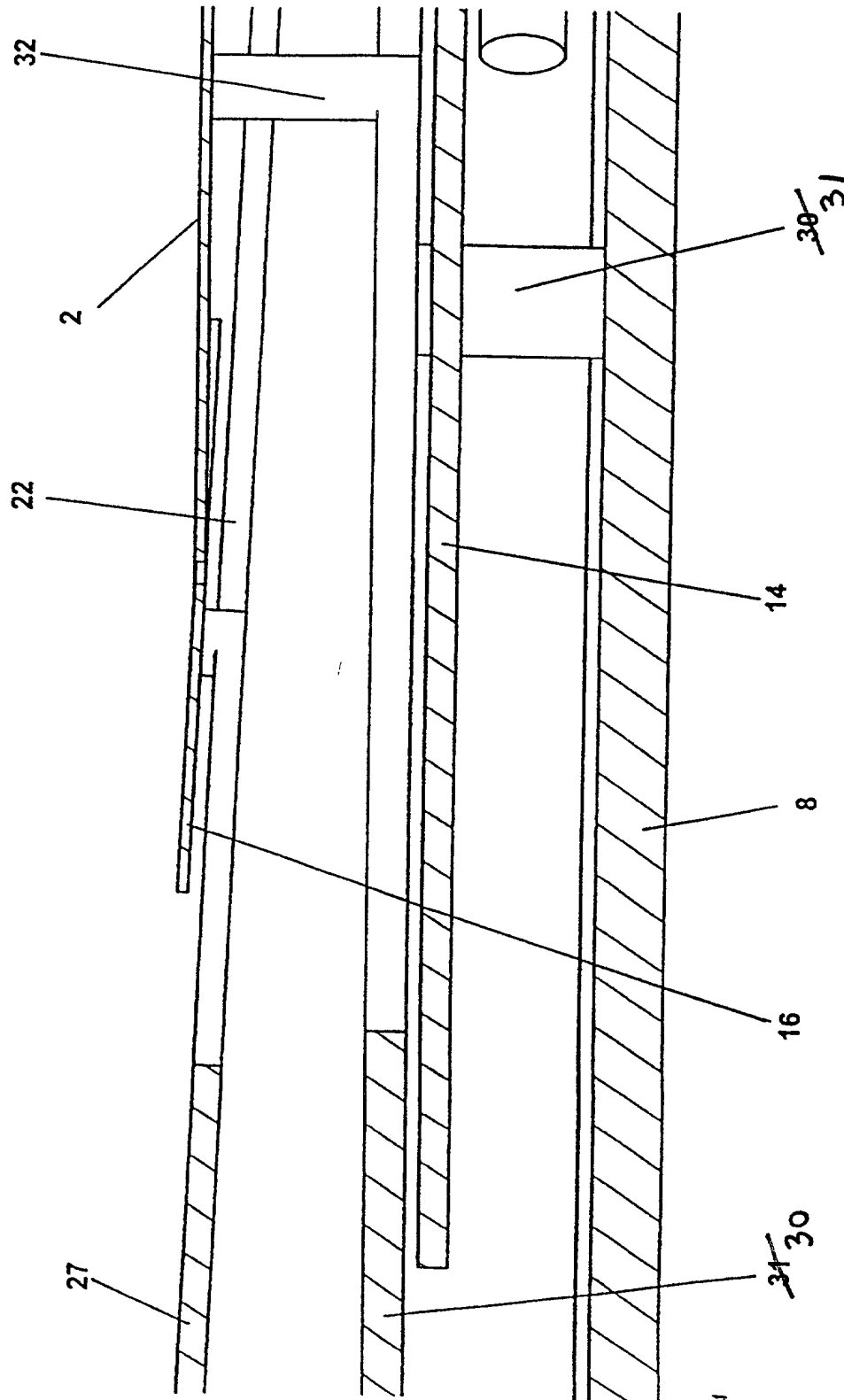
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Fig. 3



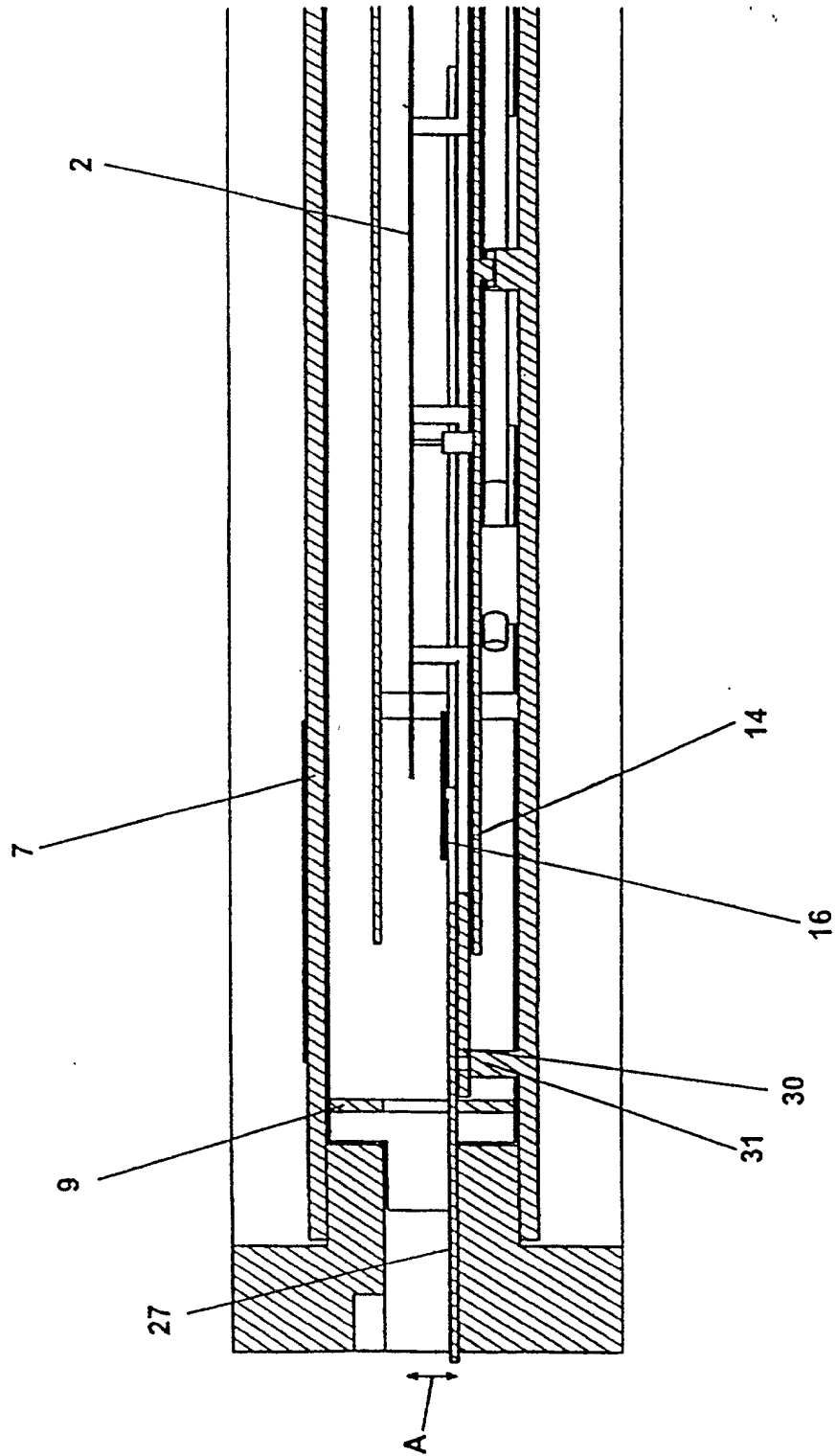
Helmut A. S. - h. v. et al.

Fig. 4



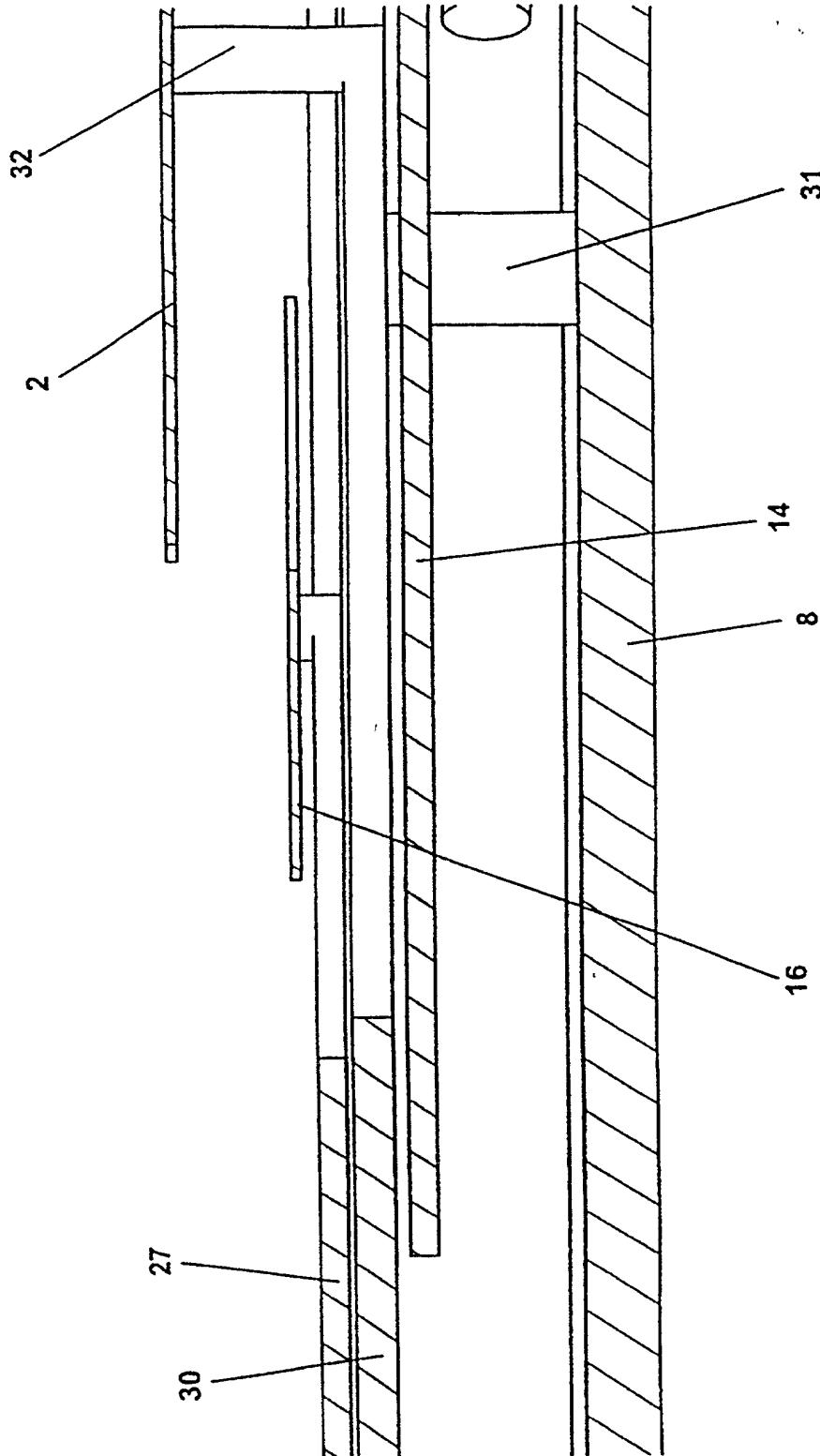
Helmut Schöner et al.

Fig. 5



Hybrid Polymer (T 2)

Fig. 6



COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought of the invention entitled:

METHOD AND APPARATUS FOR THE THERMAL TREATMENT OF SUBSTRATES

the specification of which

XX is attached hereto;
xx was filed on 30 April 1999 as ~~xxx~~ International Application Ser. No. PCT/EP99/02942, and amended herewith.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known by me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

Priority Claimed:

P 198 21 007.8

Germany

11 May 1998

Yes No
X —

(Number)

(Country)

(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below:

(Application Number)

(Filing Date)

I hereby appoint attorney Robert W. Becker, Reg. No. 26,255, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith. Address all telephone calls to (505) 286-3511. Address all correspondence to ROBERT W. BECKER & ASSOCIATES, 11896 N. Highway 14, Suite B, Tijeras, New Mexico 87059.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Helmut Aschner

Inventor's signature: Helmut Aschner

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20

Date: 11.10.00

30

Date: 13.10.00

Citizenship: German
Post Office Address: same as above

Römerstraße 21, D 7340 Amstetten DE

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